

U.S. Application No. 10/791,631  
Amendment dated October 31, 2007  
Final Office Action mailed October 15, 2007

**Amendments to the Claims:**

Please revise the claims as follows:

Claims 1-39 (cancelled)

40. (Previously presented) A method for solution mining comprising:
  - establishing at least one well into a mining zone comprising oil shale and an ore deposit primarily comprising sodium bicarbonate;
  - injecting hot aqueous liquid via the well into the mining zone, so that the hot aqueous liquid has a temperature of at least 250 °F in the mining zone and is maintained at a sufficiently high pressure to prevent the formation of carbon dioxide and water vapor;
  - forming a production solution comprising water and sodium bicarbonate; and
  - recovering the production solution from the mining zone through the well in which the hot aqueous liquid is injected.
41. (Previously presented) The method of claim 40 wherein the injection of the hot aqueous liquid is at a sufficient temperature and pressure to cause fracturing of the shale.
42. (Previously presented) The method of claim 41 wherein the rate at which the fracturing occurs is controlled by a combination of the rate of injection of the hot aqueous liquid and the temperature of the aqueous liquid.
43. (Previously presented) The method of claim 40 wherein the temperature of the aqueous liquid is at least 250 °F and not more than the equilibrium temperature corresponding to the minimum hydraulic fracture pressure of the ore deposit.

44. (Previously presented) The method of claim 40 wherein the hot aqueous liquid is selected from the group consisting of water and an aqueous solution comprising sodium bicarbonate.

45. (Previously presented) The method of claim 44 wherein the hot aqueous liquid being injected into the well includes recycled production solution from which some of the sodium bicarbonate has been recovered.

46. (Previously presented) The method of claim 44 wherein the hot aqueous liquid being injected into the well contains up to 10% sodium bicarbonate.

47. (Previously presented) The method of claim 44 wherein the hot aqueous liquid being injected into the well contains less than 5% sodium bicarbonate.

48. (Previously presented) The method of claim 44 wherein the hot aqueous liquid being injected into the well contains less than 10% sodium carbonate.

49. (Previously presented) The method of claim 44 wherein the hot aqueous liquid being injected into the well contains less than 5.5% sodium carbonate.

50. (Previously presented) The method of claim 40 wherein the pressure is less than the minimum hydraulic fracture pressure of the ore deposit being mined.

51. (Previously presented) The method of claim 50 wherein the pressure is maintained by injecting a pressurized inert gas as cap above the mining zone.

52. (Previously presented) The method of claim 51 wherein the inert gas is selected from the group consisting of nitrogen, helium, hydrogen, methane, and carbon dioxide.

53. (Previously presented) The method of claim 50 wherein the pressure is controlled by regulating the flow rate of injecting the hot aqueous liquid and the flow rate of recovering the production solution.

54. (Previously presented) The method of claim 40 wherein the solution mining is carried out in a lean oil shale interval.

55. (Previously presented) The method of claim 40 wherein the production solution is recovered at a temperature between 270 °F and 400 °F.

56. (Previously presented) The method of claim 40 wherein the production solution contains between 12 and 70% sodium bicarbonate.

57. (Previously presented) The method of claim 40 wherein the production solution contains between 15 and 47% sodium bicarbonate.

58. (Previously presented) The method of claim 40 wherein the production solution contains between 20 and 35% sodium bicarbonate.

59. (Previously presented) The method of claim 40 wherein the production solution is recovered at a pressure between 30 psig and 700 psig.

60. (Previously presented) The method of claim 40 wherein the production solution is recovered at a pressure between 150 psig and 700 psig.

61. (Previously presented) The method of claim 40 wherein the production solution is recovered at a pressure between 200 psig and 550 psig.

62. (Previously presented) The method of claim 40 wherein the well comprises at least two pipe strings and the injecting of the hot aqueous liquid and the recovering of the production solution occur in the same well.

63. (Previously presented) The method of claim 40 wherein the injecting of the hot aqueous liquid occurs at an elevation in the mining zone above the elevation in the mining zone where the recovering of the production solution occurs.

64. (Previously presented) The method of claim 40 wherein the injecting of the hot aqueous liquid occurs at an elevation in the mining zone below the elevation in the mining zone where the recovering of the production solution occurs.

65. (Previously presented) The method of claim 62 wherein the injecting of the hot aqueous liquid and the recovering of the production solution are alternated periodically.

66. (Previously presented) The method of claim 51 wherein the well comprises at least three piping strings and the injecting of the hot aqueous liquid, the injection of the inert gas, and the recovering of the production solution all occur in the same well.

67. (Previously presented) The method of claim 66 wherein the well comprises at least three concentric piping strings.

68. (Previously presented) The method of claim 67 wherein the injecting of the hot aqueous liquid occurs in an inner piping string, the recovering of the production solution occurs in an outer concentric area between concentric piping strings and the injecting of inert gas occurs in an area between concentric piping strings intermediate of the piping string carrying the hot aqueous liquid and the area carrying the production solution.

69. (Previously presented) The method of claim 51 where the injecting of the hot aqueous liquid occurs in a first piping string, the recovering of the production solution occurs in a second piping string, and first and second piping strings are contained in the same casing.

70. (Previously presented) The method of claim 40 wherein the recovered production solution is essentially clear and is free of solids and organics.

71. (Previously presented) A method for solution mining comprising:

establishing at least one well into a mining zone comprising oil shale and an ore deposit primarily comprising a water soluble salt including sodium bicarbonate;

injecting hot aqueous liquid via the well into the mining zone at a sufficient temperature and pressure to cause fracturing of the shale at a rate controlled by a combination of the rate of injection of the hot aqueous liquid and the temperature of the aqueous liquid, wherein the hot aqueous liquid has a temperature of at least 250 °F in the mining zone and is maintained at a sufficiently high pressure to prevent the formation of carbon dioxide and water vapor;

dissolving sodium bicarbonate in the hot aqueous liquid to form a production solution comprising water and sodium bicarbonate; and

recovering the production solution from the mining zone through the well in which the hot aqueous liquid is injected.

72. (Previously presented) The method of claim 71 wherein the temperature of the aqueous liquid is not more than the equilibrium temperature corresponding to the minimum hydraulic fracture pressure of the ore deposit.

73. (Previously presented) The method of claim 71 wherein the hot aqueous liquid is selected from the group consisting of water and an aqueous solution comprising sodium bicarbonate.

74. (Previously presented) The method of claim 71 wherein the hot aqueous liquid being injected into the well contains up to 10% sodium bicarbonate.

75. (Previously presented) The method of claim 71 wherein the hot aqueous liquid being injected into the well contains less than 10% sodium carbonate.

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76. (Previously presented) The method of claim 71 wherein the production solution is recovered at a temperature between 270 °F and 400 °F.

77. (Previously presented) The method of claim 71 wherein the production solution contains between 12 and 70% sodium bicarbonate.

78. (Previously presented) The method of claim 71 wherein the production solution is recovered at a pressure between 150 psig and 700 psig.